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TAN-126 / TK0563-OP

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of

Shunji Kikuhara, et al

Docket: TAN-126

Serial Number: 10/586,548

Group Art Unit: 1793

Filed: July 19, 2006

Examiner: Diana J. Liao

International Application No. PCT/JP2005/023025

International Filing Date: December 15, 2005

For: COMBUSTION CATALYST FOR TREATING DIESEL EXHAUST GAS AND  
METHOD FOR TREATING DIESEL EXHAUST GAS

DECLARATION UNDER 37 C.F.R. 1.132

I, Hitoshi KUBO, declare as follows:

I was awarded the degree of master in engineering by Nagasaki University in  
2003.

I am an inventor of the subject matter claimed in the above identified patent application.

I am aware of the office action mailed December 9, 2008 in this application.

The following examples were prepared by me or a person under my supervision in an effort to overcome the grounds of rejection stated in the office action.

Examples 13-16 of the originally filed specification:

Example 13

A catalyst was prepared by using a ceria-zirconia-praseodymium oxide as the carrier and by carrying theron iridium as the catalyst metal and further silver as an additional precious metal. A ceria-zirconia-praseodymium oxide powder (average particle size of

about 5 µm) of 1 g was impregnated with 1 g of an iridium chloride solution having an iridium content of 1.0%, dried, and calcined at 500°C for 2 hours. Thereafter, it was cleaned of chlorine and impurities, filtrated, and dried at 120°C for one night to obtain an iridium catalyst. Then, the iridium catalyst of 1 g was impregnated with 1 g of a silver nitrate solution of 3.0 wt% in silver concentration to obtain an iridium-silver catalyst (iridium loading: 1 wt%, silver loading: 3 wt%).

Example 14

As in Example 13, a catalyst was prepared by using a ceria-zirconia-praseodymium oxide as the carrier and by carrying thereon iridium as the catalyst metal and further rhodium as an additional precious metal. The iridium catalyst (iridium loading: 1 wt%), prepared by the steps as in Example 7, of 1 g was impregnated with 0.067 g of a rhodium nitrate solution of 3.0 wt% in rhodium concentration to obtain an iridium-rhodium catalyst (iridium loading: 1 wt%, rhodium loading: 0.2 wt%).

Example 15

A catalyst was prepared by using a ceria-zirconia-praseodymium oxide as the carrier and by carrying thereon iridium as the catalyst metal and further platinum as an additional precious metal. The iridium catalyst (iridium loading: 1 wt%), prepared by the steps as in Example 13, of 1 g was impregnated with 0.059 g of a dinitrodiimine platinum solution of 8.476 wt% in platinum concentration to obtain an iridium-platinum catalyst (iridium loading: 1 wt%, platinum loading: 0.5 wt%).

Example 16

A catalyst was prepared by using a ceria-zirconia-praseodymium oxide as the carrier and by carrying thereon iridium as the catalyst metal and further ruthenium as an additional precious metal. The iridium catalyst (iridium loading: 1 wt%), prepared by the steps as in Example 13, of 1 g was impregnated with 0.022 g of a solution of 4.5% ruthenium nitrate to obtain an iridium-ruthenium catalyst (iridium loading: 1 wt%, ruthenium loading: 0.1 wt%).

With respect to the catalysts of Example 12 to Example 15, mixed powders (carbon micropowder content: 5 wt%) obtained by mixing the catalysts with a carbon micropowder were heated, as in Example 1, to burn the carbon micropowder for the combustion performance test by the TG-DTA. Table 8 shows the result.

[Table 8]

Sample	Temperature for combustion initiation
Example 13 (1% Ir-3% Ag/CeO <sub>2</sub> -Pr <sub>6</sub> O <sub>11</sub> -La <sub>2</sub> O <sub>3</sub> )	280.0°C
Example 14 (1% Ir-0.2% Rh/CeO <sub>2</sub> -Pr <sub>6</sub> O <sub>11</sub> -La <sub>2</sub> O <sub>3</sub> )	286.0°C
Example 15 (1% Ir-0.5% Pt/CeO <sub>2</sub> -Pr <sub>6</sub> O <sub>11</sub> -La <sub>2</sub> O <sub>3</sub> )	285.0°C
Example 16 (1% Ir-0.1% Ru/CeO <sub>2</sub> -Pr <sub>6</sub> O <sub>11</sub> -La <sub>2</sub> O <sub>3</sub> )	285.0°C
Comparative Example 1 (5% Pt/Al <sub>2</sub> O <sub>3</sub> )	580.2°C

As known from Table 8, any of the catalysts in Example 13 to Example 16 in which iridium, and silver, rhodium, platinum or ruthenium as the additional precious metal are carried on the ceria-zirconia-praseodymium oxide carrier is confirmed to have a temperature for combustion initiation of lower than 300°C, exhibiting the favorable characteristic.

#### Supplementary Tests:

In these trials, catalysts were manufactured according to the Silver reference (US 6,455,182), one of which has a ceria-zirconia carrier and one of which has a ceria-zirconia-praseodymium oxide carrier. Additional catalysts were manufactured according to the present invention, one of which had a carrier consisting of ceria-praseodymium oxide as claimed in claim 1, and one of which had a carrier consisting of ceria-

praseodymium oxide-lanthanum oxide as claimed in claim 3. In manufacturing each of the presently claimed catalysts, the procedures of the present specification were followed. Namely, carriers of each type were prepared and each carrier of 1g was impregnated with 0.67g of a 4.5% ruthenium nitrate solution, dried, and thereafter calcined at 500°C for 0.5 hour to obtain a catalyst. The ruthenium loading of the catalyst was 3 wt%. Property evaluation of each catalyst was conducted in a test identical to the combustion tests in the present specification. In the test, the catalysts manufactured were added by and mixed with a particulate substance, namely soot discharged from a diesel engine by 5%, heated and elevated in temperature, and measured the temperature where the soot initiated combustion, i.e., the active temperature of the catalyst. The measurement condition was the same as that in the present specification.

Table 1 shows the measurement results of the temperature for combustion initiation of each of the two catalysts of Silver '182 and each of the two catalysts according to the present claims.

TABLE 1: Supplementary Test results

CATALYST	Active Temp
Present invention: CePr Carrier	289.0°C
Present invention: CeO <sub>2</sub> -Pr <sub>6</sub> O <sub>11</sub> -La <sub>2</sub> O <sub>3</sub> Carrier	285.0°C
Silver '182 Ref: CeZr Carrier	322.8°C
Silver '182 Ref: CeZrPr Carrier	315.2°C

From the above table, it is shown that the catalyst to which a carrier consisting of ceria-praseodymium oxide was applied has a lower combustion temperature than that of Silver '182's catalyst comprising zirconia. The combustion temperature is lower than 300°C,

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which is desired in the present invention since the subject's combustion should initiate at a lower temperature. While Table 1 above indeed shows that it is beneficial for the inventive catalyst to have a carrier of cerium and praseodymium oxide, the Silver '182's combination of cerium and praseodymium oxide with zirconia does not produce a desired result. Thus, the exclusion of zirconia from the inventive catalysts produces superior results. Furthermore, it is pointed out that the supplementary presence of lanthanum oxide, according to the present claim 3, additionally contributes to lowering the combustion temperature.

From this data I concluded that the presently claimed catalyst is superior in catalytic activity as compared to the zirconia-containing catalysts of Silver '182. Specifically, in the case of the presently claimed catalyst, it is preferred for the temperature for combustion initiation to be below 300°C. In contrast, all of the zirconia-containing catalysts of the Silver '182 reference have combustion temperatures of 300°C or higher, which shows that they are more difficult to combust.

The undersigned declares further that all statements made herein of his own knowledge are true and that all statements made upon information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Feb. 19. 2009

Date

Hitoshi Kubo

Hitoshi KUBO